

I Claim:

- 1 1. An apparatus for measuring speaker cone displacement in an audio speaker; the
2 apparatus comprising:
 - 3 (a) a variable reluctance sensor device; said sensor device including a first unit
4 and a second unit; one unit of said first unit and said second unit being situated in
5 fixed relation to said speaker cone; the other unit of said first unit and said second
6 unit than said one unit being situated to move in response to motion by said
7 speaker cone;
 - 8 (b) a signal injecting circuit coupled with said first unit for injecting a
9 predetermined input signal into said first unit; and
 - 10 (c) a signal receiving circuit coupled with said first unit; said signal receiving unit
11 receiving a resulting signal from said second unit and generating an indicating
12 signal based upon said resulting signal; at least one signal characteristic of said
13 indicating signal being related with said cone displacement.
- 1 2. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 1 wherein said first unit is an electromagnetic coil structure.
- 1 3. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 1 wherein said second unit is a ferrous core structure.
- 1 4. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 2 wherein said second unit is a ferrous core structure.
- 1 5. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 1 wherein said one unit is said first unit.
- 1 6. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 4 wherein said one unit is said first unit.

- 1 7. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 1 wherein said predetermined input signal is a substantially triangular wave
3 signal.
- 1 8. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 4 wherein said predetermined input signal is a substantially triangular wave
3 signal.
- 1 9. An apparatus for measuring speaker cone displacement in an audio speaker as recited
2 in Claim 6 wherein said predetermined input signal is a substantially triangular wave
3 signal.
- 1 10. An apparatus for monitoring speaker cone displacement in an audio speaker; the
2 apparatus comprising:
3 (a) an electromagnetic coil structure;
4 (b) a ferrous core structure; said ferrous core structure and said electromagnetic
5 coil structure being mounted with said speaker to effect variable electromagnetic
6 coupling between said ferrous core structure and said electromagnetic coil
7 structure as said speaker cone moves;
8 (c) a signal injecting circuit coupled with said electromagnetic coil structure for
9 injecting a predetermined input signal into said electromagnetic coil structure; and
10 (d) a signal monitoring circuit coupled with said electromagnetic coil structure;
11 said signal monitoring circuit receiving an output signal from said electromagnetic
12 coil structure and generating an indicating signal based upon said output signal; at
13 least one signal characteristic of said indicating signal being related with said cone
14 displacement.
- 1 11. An apparatus for monitoring speaker cone displacement in an audio speaker as recited
2 in Claim 10 wherein said electromagnetic coil structure is situated in fixed relation to said

3 speaker cone and said ferrous core structure is situated to move in response to motion by
4 said speaker cone.

1 12. An apparatus for monitoring speaker cone displacement in an audio speaker as
2 recited in Claim 10 wherein said ferrous core structure is situated in fixed relation to said
3 speaker cone and said electromagnetic coil structure is situated to move in response to
4 motion by said speaker cone.

1 13. An apparatus for monitoring speaker cone displacement in an audio speaker as
2 recited in Claim 10 wherein said predetermined input signal is a substantially triangular
3 wave signal.

1 14. An apparatus for monitoring speaker cone displacement in an audio speaker as
2 recited in Claim 11 wherein said predetermined input signal is a substantially triangular
3 wave signal.

1 15. An apparatus for monitoring speaker cone displacement in an audio speaker as
2 recited in Claim 12 wherein said predetermined input signal is a substantially triangular
3 wave signal.

1 16. A method for monitoring speaker cone displacement in an audio speaker; the
2 apparatus comprising the steps of:

3 (a) in no particular order:

- 4 (1) providing an electromagnetic coil structure;
5 (2) providing a ferrous core structure;
6 (3) providing a signal injecting circuit coupled with said electromagnetic
7 coil structure; and
8 (4) providing a signal monitoring circuit coupled with said
9 electromagnetic coil structure;

10 (b) mounting said ferrous core structure and said electromagnetic coil structure
11 with said speaker to effect variable electromagnetic coupling between said ferrous
12 core structure and said electromagnetic coil structure as said speaker cone moves;
13 (c) operating said signal injecting circuit to inject a predetermined input signal
14 into said electromagnetic coil structure; and
15 (d) operating said signal monitoring circuit to receive an output signal from said
16 electromagnetic coil structure and generate an indicating signal based on said
17 output signal; at least one signal characteristic of said indicating signal being
18 related with said cone displacement.

1 17. A method for monitoring speaker cone displacement in an audio speaker as recited in
2 Claim 16 wherein one of said ferrous core structure and said electromagnetic coil
3 structure is situated in fixed relation to said speaker cone and the other of said ferrous
4 core structure and said electromagnetic coil structure is situated to move in response to
5 motion by said speaker cone.

1 18. A method for monitoring speaker cone displacement in an audio speaker as recited in
2 Claim 16 wherein said predetermined input signal is a substantially triangular wave
3 signal.

1 19. A method for monitoring speaker cone displacement in an audio speaker as recited in
2 Claim 17 wherein said predetermined input signal is a substantially triangular wave
3 signal.